MOMSO – simulating eddying biogeochemistry in the Southern Ocean

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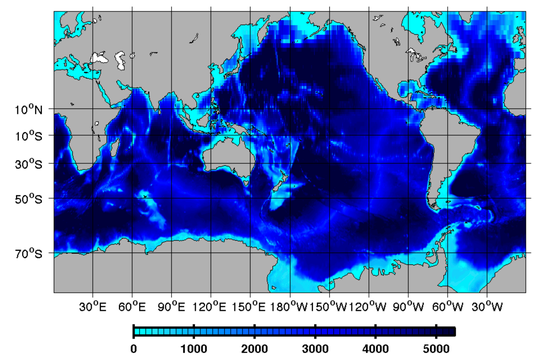
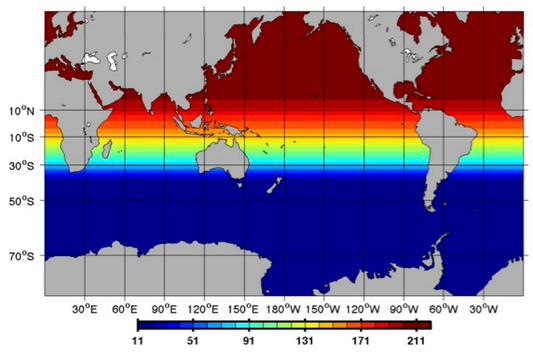
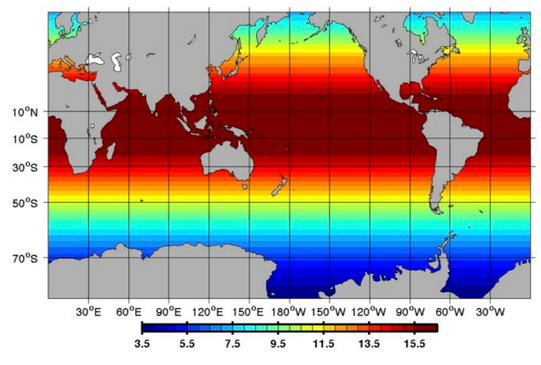
Model Configuration



Bathmetry (interpolated from ETOPO5) in units m.

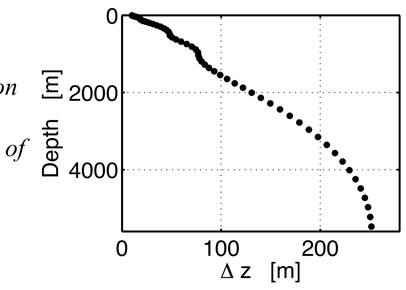


Meridional resolution in units km.

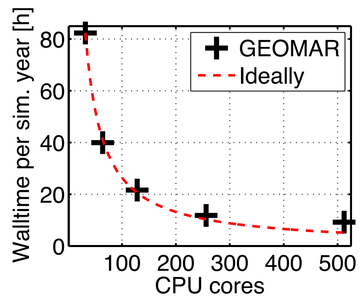


Zonal resolution in units km.

Vertical resolution as a function of depth in units m.



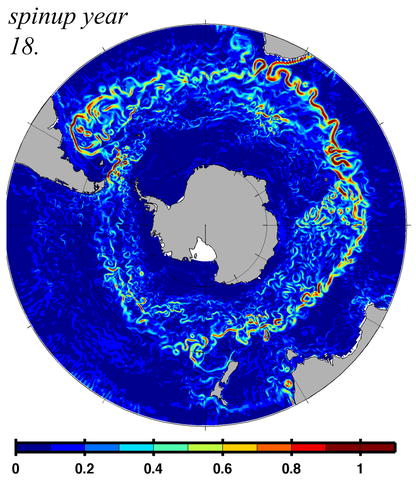
Recent advances in compute hardware have – finally - put the task to simulate biogeochemical cycles (including carbon!) in the Southern Ocean at an eddy-resolving resolution within reach. Here we report on a new configuration set-up from scratch by the biogeochemical modelling group led by A. Oschlies at GEOMAR in Kiel, Germany. The near-global configuration is dubbed MOMSO acknowledging that it is based on GFDL's **M**odular **O**cean **M**odel. **SO** stands for Southern Ocean.

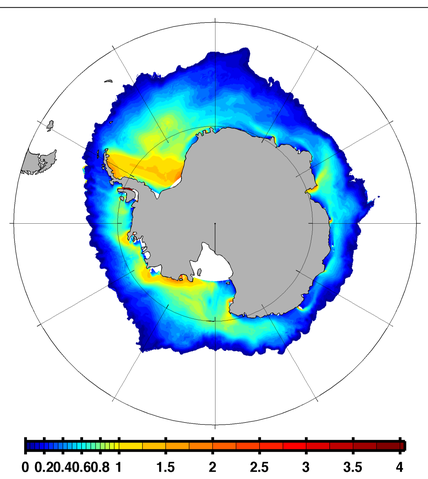


Computational performance as a function of CPU cores used simultaneously. On 500 Intel Xeon CPU E5-2670 cores it takes 10 hours to simulate on year..

Gallery

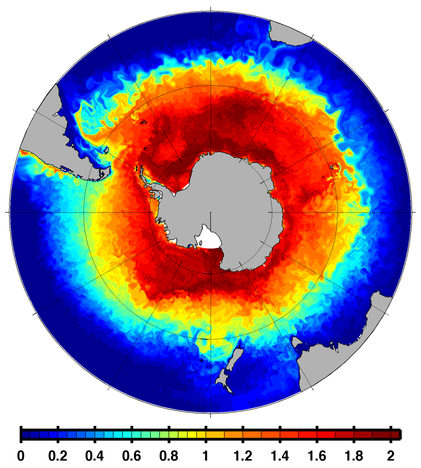
Simulated surface speed in units m/s. Snapshot from austral winter of spinup year 18.

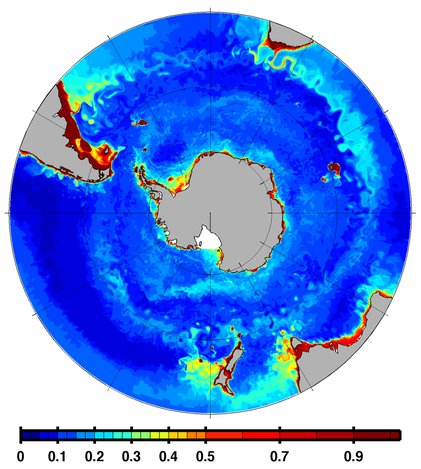




Simulated sea-ice thickness in units m. Snapshot from austral winter of spinup year 18.

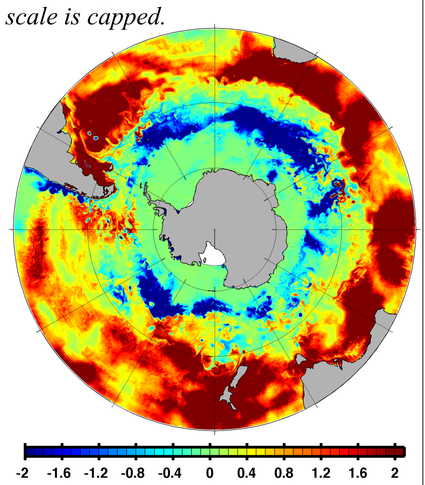
Simulated phosphate concentration at the surface in units mmolP/m³. Snapshot from austral winter of spinup year 18.





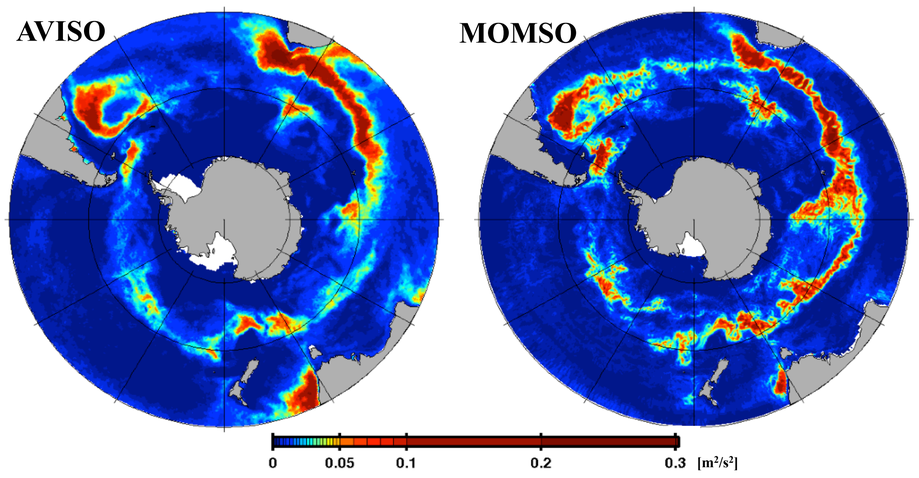
Simulated dissolved iron concentration at the surface in units nmolFe/l. Snapshot from austral winter of spinup year 18.

Simulated air-sea carbon exchange in units molC/m²/yr. Blue color denotes oceanic uptake. Note, that the color scale is capped.

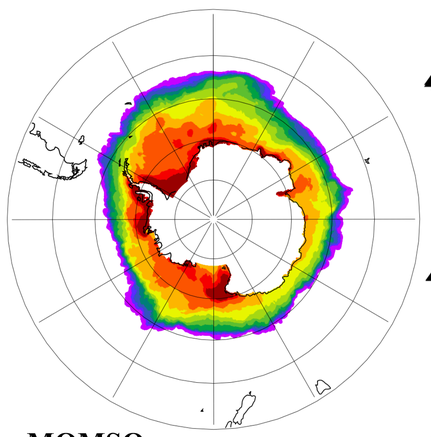


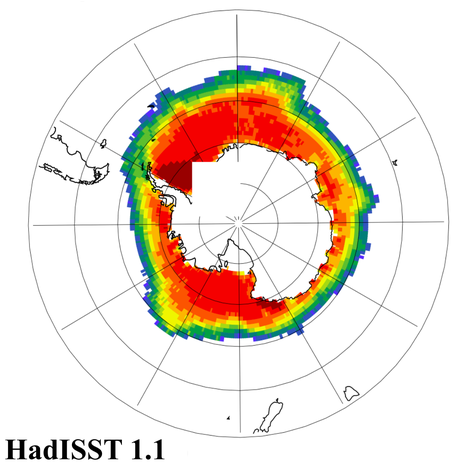
Preliminary Model Assessment

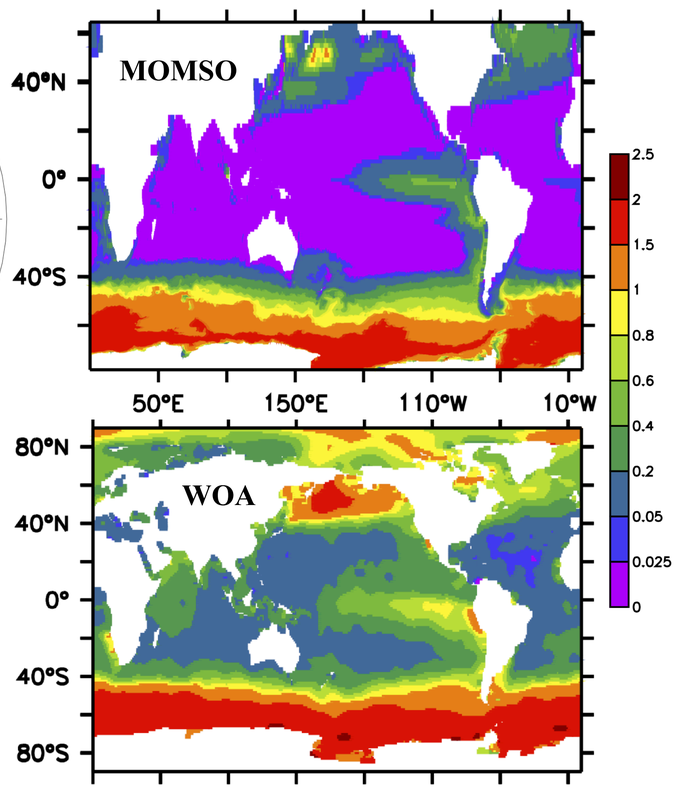
Eddy kinetic energy as derived from sea surface height variability measured from space (AVISO) along with simulated energy as diagnosed from year 18 of the spinup. Patterns and amplitudes are remarkably well reproduced.



Sea ice-covered months in a year. Maximum extent is realistic. Some-what over-estimated melting in summer (similar to our coarser-resolution models).







Surface phosphate concentration in units mmolP/m³. The color scale is non-linear! Model deficiencies in the oligotrophic gyres are - as far as we know - endemic to Michaelis-Menten based models.

MOMSO is a near-global configuration of a coupled bio-geochemical ocean circulation sea ice model.

MOMSO features a horizontal resolution of less than 11km in the Southern Ocean.

MOMSO is based on GFDL's Modular Ocean Model.

MOMSO's biogeochemical module is BLING (Galbraith et al. [2010]).

MOMSO is free

Initial conditions, forcing, grid, namelists ...
We want to share our configuration and operate a platform for download and discussions.

QR code pointing to www.baltic-ocean.org

Acknowledgement

Thanks to the MOM community and E. Galbraith for sharing their work so generously! Thanks also to CarboChange and A. Oschlies for support.